

The Genetics and Biology of
DROSOPHILA

VOLUME 3b

Edited by
M. ASHBURNER

H. L. CARSON

and
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Editorial Note on Taxonomic Usage

The use of specific names of Drosophilidae in these volumes has been made uniform with the catalogue by M. R. Wheeler in Chapter 1. Authority names are cited only in Chapter 1. In addition, although we respect the opinion of those authors who believe it is incorrect to do so, it has also been our policy to italicize the names of species groups in all chapters. Any exceptions to these policies are explained in the appropriate chapters. In particular, certain taxonomic revisions were in press at the time the catalogue was finalized for publication (May 1, 1981) or have appeared since it was published. Thus, new species not named in Wheeler's catalogue are identified by footnotes in those chapters where they are mentioned. Furthermore, some taxonomic problems, such as the status of *D. arizonensis* and *D. mojavensis* (see Chapter 1), are beyond the scope of this series of reviews. In order to avoid confusion, some reviewers have retained the original names in their discussion of the relevant literature, but have noted the existence of these unresolved problems in footnotes.

Preface

Thirty years have passed since the publication of that landmark volume, "Evolution in the Genus *Drosophila*" by Patterson and Stone. Partly because of the galvanic effect of this book, the literature on the population biology, ecology, evolutionary biology and taxonomy of *Drosophila* has grown enormously in the intervening years. The use of *Drosophila* has permitted exploration of the genetic components in an unprecedented manner in these subjects. This is the key to the great advancement these years have witnessed. As Patterson and Stone so clearly saw, techniques for studying genetic variability within and between populations provided a new and clarifying dimension for assessing the mode of origin of both species and adaptations.

Every biologist and, indeed, virtually every intelligent layman, wants intellectual fuel for the understanding of the origin of man and life. These great central biological questions have stimulated the observations and experiments described in this volume.

The revolution in evolutionary genetics which has made this volume possible has been a quiet one. The molecular genetics of protein synthesis has been generally acclaimed as the greatest triumph of modern biology. Yet, in the long run, the discoveries summarized here appear to be leading to a synthetic view of life which has an even more extraordinary philosophical depth.

The role of this volume, however, is not to make that ultimate synthesis. Rather we have asked the authors to display for the inquiring reader some of the most exciting data which have been emerging from the newer *Drosophila* work. The reader will find authoritative accounts, necessarily in considerable technical detail, of the evolutionary and population genetics of these flies. These articles will be of particular interest to those evolutionary biologists who deal with plants and animals which are less amenable to genetic analysis than *Drosophila*. Among the great variety of species discussed will be found useful analogues for diverse sorts of biogeographical and genecological research. The reader will find, perhaps to his surprise, that the sciences dealing with the systematics and ecology of the Drosophilidae have come of age in the last thirty years.

The first section of this volume deals with the world fauna. For the

first time anywhere, we offer here a catalogue which covers the *Drosophilidae* of the world. It summarizes the extraordinary wealth of species belonging to numerous genera in the two subfamilies. As the rest of the volume indicates, here lies an enormous scientific resource, the extent of which has been only vaguely realized. We then proceed to a series of geographically-oriented overviews of the various faunal realms. Such treatments are united for the first time under a single cover.

Following this is found up-to-date accounts of the genetic biology of the more intensively-worked groups of species. The research on some of these groups (*D. virilis*, for example) has not been reviewed since Patterson and Stone's work. Although the molecular and chromosomal data have been brought together, it still remains difficult for the reader to traverse the boundaries of the species groups. Nevertheless, we have not asked the authors to codify their approaches into a uniform scheme of presentation. This is a task not to be approached by editorial fiat. Indeed, we consider it one of the functions of this volume to reveal such major problems. We hope that this collection of reviews will inspire someone to undertake the reduction of these extraordinary biological data.

For the series of chapters that come after the species groups, we have solicited a series of essays summarizing the advances, mostly not reviewed heretofore, dealing with the ecology of *Drosophila*. Even a cursory examination of these chapters reveals the adaptive exuberance that these flies display. We find that the members of this worldwide family have evolved into a great variety of niches; convergent evolution is abundantly demonstrated.

Because of its key importance, we present an extensive section on genetic variability in populations. Here we see the depths to which analysis of chromosomal and polygenic variability have been developed in recent years. In 1950, molecular genetics of *Drosophila* barely existed. Now we are able to provide a perceptive assessment of the data coming out of the "decade of electrophoresis" (1966-1976). The articles in this section attempt to draw together, at least in a preliminary way, the data from the different species groups.

The other sections of the volume feature articles on the application of *Drosophila* technologies to the understanding of fundamental evolutionary problems, such as mutation, selection, competition and population structure. Here the perceptive reader will glimpse the real frontiers, especially in those areas where the theoretical has led way beyond the experimental. As one reads these essays, *Drosophila* emerges as the paramount fast-breeding diploid bisexual organism for the experimentalist.

In some of the final essays we are even able to introduce the ultimate: extraordinary developments in nucleic acid chemistry now make it possible to deal directly with DNA itself. Locked in each species is a code representing the historical accomplishment of selective and stochastic forces operating in the past. As biochemical techniques render this code more and more legible, perhaps we can dimly discern here the exciting directions in which future work will lead this subject.

Norman, Oklahoma
January 1981

MICHAEL ASHBURNER,
HAMPTON L. CARSON
and
JAMES N. THOMPSON, JR.

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At Academic Press, Roger Farrand, Anthony Watkinson and Jenny Mugridge have, by their patience and advice, been an invaluable help.

M. Ashburner
H. L. Carson
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11. Evolution and Speciation in the *Drosophila obscura* Group

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